

REMARKS

Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow.

Claims 12 and 13 are currently being amended. Claim 12 was amended to depend from claim 2.

This amendment changes claims in this application. A detailed listing of all claims that are, or were, in the application, irrespective of whether the claim(s) remain under examination in the application, is presented, with an appropriate defined status identifier.

After amending the claims as set forth above, claims 1-14 are now pending in this application.

Drawings

In the Office Action, figures 1-3D were objected to for not being labeled prior art. Applicants respectfully submit that Figures 1-3D are not prior art in that they illustrate elements of the claimed invention. In compliance with 37 CFR § 1.81, Figures 1-3D were provided for the understanding of the subject matter patented. Figure 1 illustrates an apparatus according to one embodiment of the invention. Specifically, the permanent memory MEM and processor μP displayed in FIG. 1 store and execute software for calculating the positions of vertices and the resultant forces of these vertices as claimed in claim 1.

Figures 2A-2B illustrate examples of triangular meshes with notations for the points of the triangle subsequently used by the apparatus claimed in claim 1 in estimating the composition of the forces at each vertex of the triangle. Figures 3A-3D illustrate examples of tetrahedrons which aid in demonstrating how the sums on the edges and pairs of the edges of a tetrahedron are calculated, in order for the apparatus claimed in claim 1 to evaluate a force acting on vertex P_p of the tetrahedron. In sum, Applicants submit that FIGS 1-3D are directed to limitations present in the pending claims. Therefore, Applicants respectfully

request withdrawal of the objection and that the drawing Figures 1-3D be accepted as originally submitted.

Claim Rejections under 35 U.S.C. § 112

Claim 13 was rejected under 35 U.S.C. § 112, second paragraph. In response, Applicants amend claim 13. Applicants submit that claim 13 now particularly points out and distinctly claims the subject matter of the claimed invention. Thus, Applicants respectfully request that the rejection be withdrawn.

Claim Rejections under 35 U.S.C. § 102

Claims 1-14 were rejected under 35 U.S.C. § 102(b) as being anticipated by Delingette "Toward Realistic Soft-Tissue Modeling in Medical Simulation" (1997) hereinafter "Delingette."

In response, Applicants respectfully traverse the rejection of claims 1-14. Applicants rely on M.P.E.P. § 2131, entitled "Anticipation – Application of 35 U.S.C. § 102(a), (b) and (e)" which states, "a claim is anticipated only if each and every element set forth in the claim is found, either expressly or inherently described, in a single prior art reference." Applicants respectfully submit that Delingette does not disclose, teach or suggest each and every element of independent claim 1.

Claim 1 is directed to an apparatus for simulating the deformation of materials, comprising a computer having a module configured to "determine repeatedly, for each mesh, the deviation between the current length of an edge of the mesh and its previous length and/or its length at rest, and to store respective force data relating to a potential energy of deformation for each vertex of the mesh, the respective force data being obtained from said deviation..." Thus, the module claimed in independent claim 1 obtains force data from a deviation of the length of an edge of the mesh (*See* Formula 12).

In the Office Action, the Examiner repeatedly cites and relies on the second paragraph in the right column on page 514 and the fourth paragraph in the left column on page 519 of

Delingette as disclosing the above-referenced limitations. However, a careful reading of these passages does not support the Examiner's assertions. For example, the passages on page 514 discuss considering "surgical instruments as moving meshes and soft tissue as deformable moving meshes." The left column on page 519 of Delingette briefly mentions that "[l]inear elastic volumetric finite element models have been widely used to model deformation in soft tissue."

However, Delingette fails to disclose, teach or suggest any of the specific technical limitations recited in independent claim 1. Specifically, Delingette does not disclose an apparatus for simulating the deformation of materials wherein a first module is configured to determine repeatedly, for each mesh, the deviation between the current length of an edge of the mesh and its previous length and/or its length at rest. Furthermore, Delingette fails to teach a simulation apparatus configured to obtain "force data relating to a potential energy of deformation for each vertex of the mesh" from the deviation between the current length of an edge of the mesh and its previous length and/or its length at rest.

In sum, while Delingette broadly discusses soft-tissue modeling, it does not disclose, teach or suggest the technical features claimed in claims 1-14. As stated above, the apparatus claimed in claim 1 is configured to determine the deviation between the current length of an edge of a mesh and the resting length of an edge of the mesh in order to estimate a derivative of the potential energy of the deformation of each mesh. This estimate is expressed as a function of a Green-St Venant tensor and mechanical coefficients inherent in the material of the mesh. The force or composition of forces exerted at the subject vertex is obtained by expressing the derivative of the potential energy in relation to the position of the vertex. The claimed invention can thus be used to simulate large movements and/or non-linear elasticity of objects formed of various materials.

In light of the above, Applicants submit that claim 1, as currently amended, is not anticipated by Delingette and respectfully request that the rejection be withdrawn. Applicants also respectfully request that the Examiner withdraw the rejections to claims 2-14, which depend on claim 1 and are allowable for at least the reasons set forth above.

Conclusion

Applicant believes that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

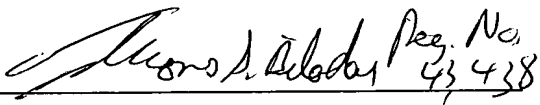
The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.


The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check or credit card payment form being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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